

Acceleration

In your own words explain what you think acceleration is.

- is increasing speed over a period of time

Give some examples of things that accelerate. - if it moves it can accelerate

Acceleration = $\frac{\text{change in velocity}}{\text{change in time}}$

$$a = \frac{\Delta v}{\Delta t} \quad \text{OR} \quad a = \frac{v_f - v_i}{t_f - t_i}$$

v_f = final velocity

v_i = initial velocity/beginning velocity

t_f = time at the end of observations

t_i = time at the beginning of observation (often zero)

Velocity = describes both the speed and direction of motion.

• When velocity is increasing, it is called acceleration

• When velocity is slowing down we say deceleration or negative acceleration

→ If the ratio of velocity to time is the same throughout the acceleration, then it is called **constant acceleration**.

→ When acceleration varies over a period of time it is described as **average acceleration**.

To calculate the final velocity use:

$$v_f = v_i + a(t_f - t_i)$$

BEOMAS?

To calculate the initial velocity use:

$$v_i = v_f - a(t_f - t_i)$$

To calculate the final time use:

$$t_f = \frac{v_f - v_i}{a}$$

Example 1:

What is the acceleration if a car speeds up from 10km/hr to 30km/hr in 10s?

$$\begin{aligned} a &= ? & a &= \frac{v_f - v_i}{t_f - t_i} \\ v_i &= 10 \text{ km/hr} & t_f - t_i &= \\ v_f &= 30 \text{ km/hr} & &= \frac{30 \text{ km/hr} - 10 \text{ km/hr}}{10 \text{ s}} \\ t_i &= 0 \text{ s} & &= \frac{20 \text{ km/hr}}{10 \text{ s}} = 2 \text{ km/hr/s} \\ t_f &= 10 \text{ s} & & \end{aligned}$$

Hints:

- How fast = velocity
- How far = distance
- How quickly something changes = acceleration

Example 2:

What is the acceleration if a runner goes from 3m/s to 8 m/s in 2 seconds?

$$\begin{aligned} a &= ? & a &= \frac{v_f - v_i}{t_f - t_i} \\ v_i &= 3 \text{ m/s} & &= \frac{8 \text{ m/s} - 3 \text{ m/s}}{2 \text{ s}} = 2.5 \text{ m/s}^2 \\ v_f &= 8 \text{ m/s} & &= \frac{5 \text{ m/s}}{2 \text{ s}} = 2.5 \text{ m/s/s} \\ t_i &= 0 \text{ s} & & \\ t_f &= 2 \text{ s} & & \end{aligned}$$

Example #3:

Myriam Bedard accelerates at an average 2.5 m/s^2 for 10.5s. What is her final velocity at the end of 10.5s?

$$\begin{aligned} a &= 2.5 \text{ m/s}^2 & v_f &= v_i + a(t_f - t_i) \\ v_i &= 0 \text{ m/s} & &= 0 \text{ m/s} + 2.5 \text{ m/s}^2 (10.5 \text{ s} - 0 \text{ s}) \\ v_f &= ? & &= 0 \text{ m/s} + 2.5 \text{ m/s}^2 (10.5 \text{ s}) \\ t_i &= 0 \text{ s} & &= 0 \text{ m/s} + 26.25 \text{ m/s} \\ t_f &= 10.5 \text{ s} & &= 26.25 \text{ m/s} \end{aligned}$$